CLAIMS

1. A communication control system for causing a communication station performing communication in accordance with a standard protocol to perform multiplex communication based on time division of a communication band, the communication control system comprising:

a time slot assignment section which divides a communication cycle as a basic cycle of time division into time slots, and assigns a set of communication stations and a type of a communication section to each of the time slots; and

a time-division multiplex communication section which performs communication within a period of the time slot in accordance with the set of communication stations and type of communication section assigned by the time slot assignment section.

2. The communication control system according to claim 1, wherein the set of communication stations is generated by grouping the communication stations based on addresses of the respective communication stations.

3. The communication control system according to claim 1 or 2, wherein the type of the communication section includes at least one of time-synchronous communication, 1-to-N non-cyclic data communication, 1-to-N cyclic data

communication, 1-to-1 non-cyclic data communication and 1-to-1 cyclic data communication.

4. The communication control system according to claim 3, wherein the 1-to-1 non-cyclic data communication is at least one of an acknowledge type communication which is the 1-to-1 non-cyclic data communication and in which a receiving station returns an acknowledgment to a transmitting station when the receiving station normally receives data, and a negative acknowledge type communication which is the 1-to-1 non-cyclic data communication and in which the receiving station returns a negative acknowledgment to the transmitting station when the receiving section cannot receive the data normally.

5. The communication control system according to claim 1, 2 or 4, wherein each communication station is equipped with a timer section and a time-synchronous communication section, and

time of the timer section of each communication station and the time slots of all communication stations are synchronized by the time-synchronous communication section.

6. The communication control system according to claim 1, wherein the communication section is a communication section for performing 1-to-N non-cyclic data communication, and

the communication section includes:

a data transmission section for broadcasting data packets to a group address as destinations of a plurality of communication stations; and

a data reception section for receiving a transmitted data packet when a destination address of the transmitted data packet is a group address to which the home communication station belongs.

7. The communication control system according to claim 1, wherein the communication section is a communication section for performing 1-to-N cyclic data communication, and

the communication section includes:

a data transmission section for broadcasting data packets in a fixed cycle to a group address as destinations of a plurality of communication stations;

a plurality of receive buffers each of which stores reception time of a received data packet and the data packet as a pair;

a packet reception section which attaches the reception time to the received data packet and sequentially stores the data packet one by one into the plurality of receive buffers when a destination address of the received data packet is a group address to which the home communication station belongs; and

a receive buffer reading section which reads the data packet from the receive buffer having the latest reception time among the plurality of receive buffers, completes readout in a period shorter than the cycle of the broadcasting, and sends the data packet to a higher-level side.

8. The communication control system according to claim 1, wherein the communication section is a communication section for performing 1-to-1 non-cyclic data communication and an immediate-response type communication, and

the communication section includes:

a data transmission section for transmitting a data packet to a single communication station, and retransmits the data packet in a case where a normal acknowledgment is not returned from a receiving station within a predetermined time; and

a data reception section for transmitting a normal acknowledgment when a data packet is normally received.

9. The communication control system according to claim 8, wherein the data transmission section retransmits the data packet independently of the time slot.

10. The communication control system according to claim 8, wherein the data reception section transmits the normal acknowledgment independently of the time slot.

11. The communication control system according to claim 1, wherein the communication section is a communication section for performing 1-to-1 non-cyclic data communication and a negative acknowledge type communication, and

the communication section includes:

a data transmission section for transmitting a data packet with a sequence number being attached, the sequence number being changed for each transmission; and

a data reception section which checks a sequence number being attached to a data packet each time the data packet is received, and transmits a negative acknowledgment packet to a transmitting station when detecting a lost sequence number as a result of checking.

12. The communication control system according to claim 11, wherein the data reception section attaches a sequence number specifying the data packet that is received normally at the latest to the negative acknowledgment packet, and

when the data transmission section receives the negative acknowledgment packet, the data transmission section sequentially retransmits data packets starting with an undelivered data packet being specified by the sequence number attached to the negative acknowledgment packet.

13. The communication control system according to claim 11, wherein when the data transmission section does not transmit a subsequent data packet for a predetermined time on completion of the transmission of the data packets, the data transmission section transmits a delivery acknowledgment packet to a receiving station, and when a sequence number specified by a returned acknowledgment packet does not indicate the last transmitted data packet, the data transmission section sequentially retransmits data packets starting with an undelivered data packet specified by the returned acknowledgment packet, and

when the data reception section receives the delivery acknowledgment packet, the data reception section returns to the transmitting station an acknowledgment packet to which a sequence number specifying the last received data packet is attached.

14. The communication control system according to any one of claims 11 to 13, wherein the data reception section performs transmission of the negative acknowledgment packet and the acknowledgment packet independently of the time slot.

15. The communication control system according to claim 1, wherein the communication section is a communication section for performing 1-to-1 cyclic data communication, and

the communication section includes:

a transmission requesting section for requesting cyclic transmission of a data packet addressed to a specified communication station by a start request packet, based on a data acquisition request;

a halt requesting section for requesting a halt of cyclic transmission of the data packet by a halt request packet;

a data transmission section which, when receiving the start request packet, starts transmission of a data packet being specified by the start request packet to a communication station of a requesting source in a cycle specified by the start request packet, and halts transmission of the data packet on receiving a halt request packet; and

a data reception section for receiving the data packet.

16. The communication control system according to claim 15, wherein the data reception section includes:

a plurality of receive buffers each of which stores reception time of the received data packet and the data packet as a pair;

a packet reception section which attaches the reception time to the received data packet and sequentially stores the data packet one by one into the plurality of receive buffers; and

a receive buffer reading section which reads the data

packet from the receive buffer having the latest reception time among the plurality of receive buffers, completes readout in a period shorter than the cycle specified by the start request packet, and sends the data packet to a higher-level side.

17. A communication control system for controlling communication among a plurality of communication stations in accordance with a standard protocol, the communication control system comprising:

a plurality of transmission queue sections which exists between predetermined layers of an OSI layer model, is provided for each type of communication and constitutes a queue of transmission packets;

a plurality of reception queue sections which exists between predetermined layers of the OSI layer model, is provided for each type of the communication and constitutes a queue of reception packets;

a transmission section for transmitting packets in the plurality of transmission queue sections in accordance with a predetermined priority order with priority information corresponding to the transmission queue section being attached;

a reception section for distributing and storing received packets in the plurality of reception queue sections in accordance with the priority information; and

a reading section which reads data stored in the plurality

of reception queue sections in accordance with a predetermined priority order, and sends the data to a higher-level side.

18. The communication control system according to claim 17, wherein the transmission section executes transmission processing of specific transmission queue section among the plurality of transmission queue sections in a case where data does not exist in the transmission queue section that has higher priority over the specific transmission queue section.

19. The communication control system according to claim 17, wherein the reading section executes reading processing of specific reception queue section among the plurality of reception queue sections in a case where data does not exists in the reception queue section that has higher priority over the specific reception queue section.

20. The communication control system according to claim 1 or 17, wherein the transmission queue section and the reception queue section exist between a second layer and a third layer of an OSI layer model.

21. The communication control system according to claim 1 or 17, wherein the standard protocol is UDP or IP.